FIITJEE RET – 10

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2017 (P2)_SET–A

DATE: 03.09.2018

Time: 3 hours **Maximum Marks: 183**

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 54 questions.
2. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
3. Fill in the boxes provided for Name and Enrolment No.
4. The answer sheet, a machine-readable Objective Response (ORS), is provided separately.
5. DO NOT TAMPER WITH / MULTILATE THE ORS OR THE BOOKLET.

B. Filling in the OMR:

6. The instructions for the OMR sheet are given on the OMR itself.

C. Question paper format & Marking Scheme

7. Each part has three sections as detailed in the following table:

Section	Question Type	Number of Questions	Category wise Marks Each Question				Maximum marks of the section
			Full Marks	Partial Marks	Zero Marks	Negative Marks	
1	**Single Correct Option**	7	**+3** If only the bubble corresponding to the correct option is darkened	——	**0** If none of the bubbles is darkened	**–1** In all other cases	**21**
2	**One or more correct option(s)**	7	**+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.	**+1** For darkening a bubble corresponding to each correct option, provided **NO** incorrect option is darkened.	**0** If none of the bubbles is darkened.	**–2** In all other case.	**28**
3	**Comprehension**	4	**+3** If only the bubble corresponding to the correct option is darkened	——	**0** In all other case.	——	**12**

Don't write / mark your answers in this question booklet.
If you mark the answers in question booklet, you will not be allowed to continue the exam.

NAME: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐☐☐

PAPER–II
PART I: PHYSICS
SECTION 1 (Maximum Marks: 28)

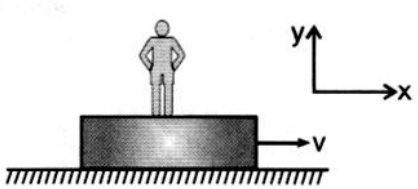
* This section contains **SEVEN** questions.
* Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
* For each question, darken the bubble corresponding to all the correct option in the ORS.

1. A shell of mass 2 m projected with a speed 'u' at an angle θ to the horizontal explodes at the highest point of its motion into two pieces of mass 'm' each. If one piece whose initial speed is zero, falls vertically, find the distance at which the other piece will fall from the point of projection.

(A) $\frac{3u^2 \sin 2\theta}{g}$ (B) $\frac{3}{2}\frac{u^2 \sin 2\theta}{g}$

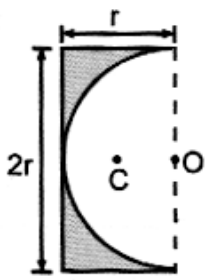
(C) $\frac{u^2 \sin 2\theta}{g}$ (D) None of these

2. A man and a plank of same mass are moving with a velocity v along positive x –axis. At some time man jumps along negative x – axis with a velocity v with respect to ground, then the speed of the plank is.



(A) v (B) 2 v
(C) 3 v (D) None of these

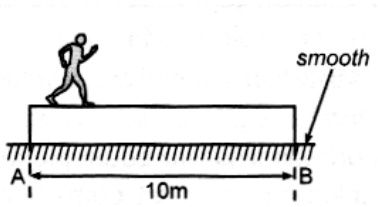
3. A semicircular portion of radius 'r' is cut from a uniform rectangular plate as shown in figure. The distance of centre of mass 'C' of remaining plate, from point 'O' is



(A) $\frac{2r}{(3-\pi)}$ (B) $\frac{3r}{2(4-\pi)}$

(C) $\frac{2r}{(4+\pi)}$ (D) $\frac{2r}{3(4-\pi)}$

4. In the figure shown mass of person is 40 kg and mass of plank is 20 kg. If person reaches the other end in 2 seconds with constant velocity, then find the velocity of person (w.r.t ground). Initially the system was at rest.



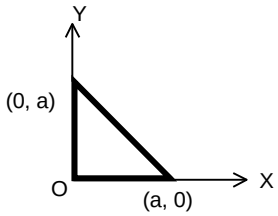
(A) $5/3$ ms^{-1} (B) 5 ms^{-1}

(C) $10/3$ ms^{-1} (D) None of these

Space for rough work

5. Two particles of equal masses have velocities $\vec{v}_1 = 2\hat{i}\ m/s$ and $\vec{v}_2 = 2\hat{j}\ m/s$. The first particle has an acceleration $\vec{a}_1 = \left(3\hat{i} + 3\hat{j}\right) m/s^2$, while the acceleration of the other particle is zero. The centre of mass of the two particles moves in a
(A) circle (B) parabola (C) straight line (D) ellipse

6. Three rods of the same mass are placed as shown in the figure. What will be the co-ordinate of centre of mass of the system?
(A) (a/2, a/2) (B) (a/√2, a/√2)
(C) (a/3, a/3) (D) none of these



7. A particle of mass 4m which is at rest explodes into three fragments. Two of the fragments each of mass m are found to move with a speed 'v' each in mutually perpendicular directions. Find the minimum energy released in the process of explosion.
(A) $(2/3)mv^2$ (B) $(3/2)mv^2$ (C) $(4/3)mv^2$ (D) $(3/4)mv^2$

SECTION 2 (Maximum Marks: 15)

- This section contains **SEVEN** questions.
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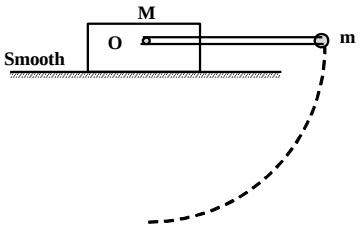
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get –2 marks, as a wrong option is also darkened.

8. Two particles of masses m and 2m move with accelerations $2a\hat{i}$ and $-a\hat{i}$ respectively.
(A) the acceleration CM is zero
(B) the net force acting on (m + 2m) is zero
(C) the velocity of CM must be zero
(D) the bodies must interact with each other

Space for rough work

9. A block of mass M is placed on a smooth horizontal floor. The block has a massless rod of length ℓ pivoted on it at point O. The rod has a point mass m attached to its end. The whole system is released from the position shown. Then



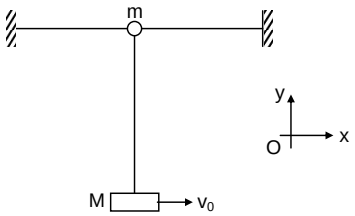
(A) The velocity of M when the rod becomes vertical is $m\sqrt{\frac{2g\ell}{M(M+m)}}$

(B) The velocity of M when the rod becomes vertical is $M\sqrt{\frac{2g\ell}{m(M+m)}}$

(C) Horizontal acceleration of centre of mass of the system is always zero.

(D) At any time linear momentum of the system will be conserved in horizontal direction

10. A block of mass M suspended from a smooth ring of mass m by an inextensible light string of length ℓ is pushed towards the right with a speed v. If the ring can slide along the horizontal rod, then, for the system (M + m)



(A) at any instance $(a_C)_x = 0$

(B) initially $(a_C)_y = \frac{v^2}{\ell} \uparrow$

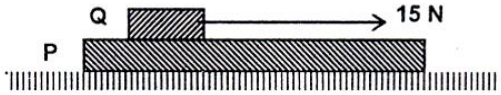
(C) initially N = (M + m)g + $\frac{Mv^2}{\ell}$, where N = normal reaction between the ring and horizontal rod

(D) initially $T = \frac{Mmv^2}{(M+m)\ell}$, where T = tension in the string

11. When a bullet is fired from a gun
(A) kinetic energy of bullet is more than that of gun
(B) acceleration of bullet is more than that of gun during firing
(C) momentum of bullet is more than that of gun
(D) velocity of bullet is more than that of gun

Space for rough work

12. A long plank P of mass 5 kg is placed on a smooth floor. On P is placed a block Q of mass 2 kg. The coefficient of friction between P and Q is 0.5. A horizontal force of 15N is applied to Q, as shown in figure and you may take g as 10 N/kg. Now,



(A) the reaction force on Q due to P is 10 N
(B) the acceleration of Q relative to P is 2.5 m/s^2
(C) the acceleration of P relative to the floor is 2.0 m/s^2
(D) the acceleration of centre-of-mass of P + Q system relative to the floor is 15/7 m/s^2

13. If the external forces acting on a system have zero resultant then the centre of mass
(A) must not move (B) may move
(C) must not accelerate (D) may accelerate

14. A non-zero external forces acts on a system of particles. At any instant t, the velocity and the acceleration of Centre of mass are found to be u_0 and a_0 . Then it is possible that
(A) $u_0 = 0; a_0 = 0$ (B) $u_0 \neq 0; a_0 \neq 0$ (C) $u_0 \neq 0; a_0 = 0$ (D) $u_0 = 0; a_0 \neq 0$

SECTION 3 (Maximum Marks: 18)

∗ This section contains **TWO** paragraphs.
∗ Based on each paragraph, there are **TWO** questions.
∗ Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
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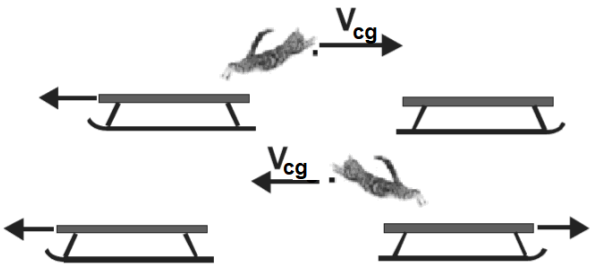
Paragraph–1

A strange cat with a mass m_c is sitting at rest on the left sled of a pair of identical sleds. The sleds have mass m_s and sit on frictionless ice. Suddenly, the cat leaps to the right sled, traveling with a horizontal speed V_{cg} measured with respect to the ground. The instant the cat reaches the right sled, it turns around and leaps back to the left sled. The horizontal component of the cat's speed is again V_{cg} measured with respect to the ground.



15. What is the final speed of the right sled ?
(A) $\frac{2m_cV_{cg}}{m_s}$ (B) $\frac{m_cV_{cg}}{m_s}$ (C) $\frac{2(m_c+m_s)V_{cg}}{m_s}$ (D) zero

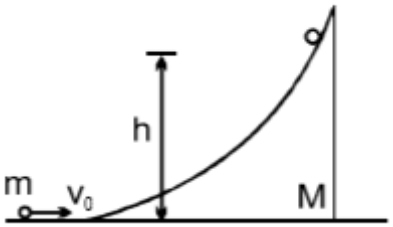
Space for rough work

16. What is the final speed of Left sled in terms of the masses of the cat and sleds and the cat's leaping speed ? (The cat remains on the left sled after its return)

(A) $\frac{2m_c v_{cg}}{m_s + m_c}$ (B) $\frac{2m_s v_{cg}}{m_s + m_c}$ (C) $\frac{2m_c v_{cg}}{m_s}$ (D) $\frac{m_c v_{cg}}{m_s}$

Paragraph–2

A particle of mass m moving horizontal with v_0 strikes a smooth wedge of mass M, as shown in figure. After collision, the ball starts moving up the inclined face of the wedge and rises to a maximum height h on it. After that it starts sliding down the inclined. Now Answer the questions
Take all the surfaces smooth



17. The maximum height h attained by the particle is

(A) $\left(\frac{m}{m+M}\right)\frac{v_0^2}{2g}$ (B) $\left(\frac{m}{M}\right)\frac{v_0^2}{2g}$ (C) $\left(\frac{M}{m+M}\right)\frac{v_0^2}{2g}$ (D) None of these

18. Suppose m = M then what will be the maximum velocity attained by the inclined wedge during the entire motion ?

(A) $\frac{v_0}{2}$ (B) v_0 (C) $\frac{v_0}{4}$ (D) None of these

Space for rough work

PART II: CHEMISTRY

SECTION 1 (Maximum Marks: 28)

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19. For the equilibrium $AB\ g \rightleftharpoons A\ g + B\ g$, at a given temperature $\frac{1}{3}rd$ of AB is dissociated, then $\frac{P}{K_p}$ will be numerically equal to.....

(A) 4 (B) 6 (C) 8 (D) 2

20. For the equilibrium, $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, $K_c = \frac{\alpha^2}{(1-\alpha)V}$, temperature remaining constant

(A) K_c will increase with the increase in volume
(B) K_c will increase with the decrease in volume
(C) K_c will not change with the change in volume
(D) K_c may increase or decrease with the change in volume depending upon its numerical value

21. For the reaction, A $\rightleftharpoons$ B. $E_{a(f)}$ and $E_{a(b)}$ value are 30.5 and 40.5 Kcal/mol respectively. Calculate ΔH for the forward reaction.

(A) –10 Kcal/mole (B) 71 kcal/mole
(C) –71 Kcal/ mole (D) +10 kcal/mole

22. For a reversible reaction $2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$ total pressure of the system at equilibrium 2.4 atm. Partial pressure N_2 and H_2 at equilibrium are 0.8 atm and 0.4 atm respectively calculate Kp.

(A) 0.355 (B) 0.00395 (C) 0.0355 (D) 0.0395

23. Which of the following is not considered as vander waals' force ?

(A) dipole–dipole interaction (B) ion–dipole interaction
(C) dipole–induced dipole interaction (D) London forces

Space for rough work

24. 2 moles of PCl_5 is present in vessel 2 lit capacity, at equilibrium 40% of PCl_5 is dissociates, calculate Kc
(A) 0.366 (B) 0.266 (C) 26.6 (D) 0.466

25. Eight mole of a gas AB_3 attain equilibrium in a closed vessel of volume $2dm^3$ as,
$2AB_3 \rightleftharpoons A_2(s) + 3B_2(g)$. If at equilibrium 2 mole of A_2 are present, then equilibrium constant is
(A) 27 $mol^2 . L^{-2}$ (B) 6.75 $mol^2\ L^{-2}$ (C) 3 $mol^2\ L^{-2}$ (D) 36 $mol^2\ L^{-2}$

SECTION 2 (Maximum Marks: 15)

- This section contains **SEVEN** questions.
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- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get –2 marks, as a wrong option is also darkened.

26. $N_2 + O_2 \rightleftharpoons 2NO, K_1; \left(\frac{1}{2}\right)N_2 + \left(\frac{1}{2}\right)O_2 \rightleftharpoons NO, K_2;$

$2NO \rightleftharpoons N_2 + O_2, K_3; NO \rightleftharpoons \left(\frac{1}{2}\right)N_2 + \left(\frac{1}{2}\right)O_2, K_4$

Correct relation(s) between K_1, K_2, K_3 and K_4 is/are :
(A) K_1 x K_3 = 1 (B) $\sqrt{K_1} \times K_4 = 1$
(C) $\sqrt{K_3} \times K_2 = 1$ (D) None of these

27. Equilibrium constant is independent of
(A) initial concentration of reactants and products (B) pressure
(C) temperature (D) catalyst

28. Favourable conditions for the forward reaction.
$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ ΔH = –ve
(A) Addition of N_2 & H_2 time to time (B) removal of NH_3 time to time
(C) High pressure (D) low temperature

Space for rough work

29. In which of the following equilibrium, the value of Kp is less than Kc ?

(A) $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ (B) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

(C) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ (D) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

30. In the reaction, $A_2(g) + 4B_2(g) \rightleftharpoons 2AB_4(g), \Delta H > 0$. The decomposition of AB_4(g) will be favoured at

(A) low temperature & high pressure
(B) high temperature & low pressure
(C) low temperature & Low pressure
(D) high temperature & high pressure

31. For the reaction, $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$, the forward reaction at constant temperature is favoured by :

(A) introducing an inert gas at constant volume
(B) introducing chlorine gas at constant volume
(C) introducing an inert gas at constant pressure
(D) increasing the volume of the container .

32. Which of the following statement(s) is/are correct about chemical equilibrium
(A) It is dynamic in nature
(B) by using catalyst position of equilibrium changes
(C) at equilibrium rate of forward reaction is equal to rate of backward reaction.
(D) at equilibrium always concentration of reactants is equal to concentration of products.

Space for rough work

SECTION 3 (Maximum Marks: 18)

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Paragraph–1

The concept of H–bonding was introduced to explain the abnormality in some molecules. H–atom covalently linked with N, O or F in a molecule is held up on other side with dipole–dipole attraction with same or other molecule of same or other compound show H–bonding. H–bonding between two molecules in called intermolecular H–bonding. H–bonding within a molecule is called intramolecular H–bonding or chelation. Intermolecular H–bonding give rise to cluster formation.

33. Which of the following statement is wrong :
(A) para nitrophenol is less volatile than ortho nitro phenol
(B) The H–bond strength decreasing order is :
H–F - - - - H > H–O - - - H > H – N - - -H
(C) All the three atoms (e.g., F–H - - -F–H) involved lie in one plane
(D) H–bonding is stronger than covalent bond.

34. KF combines with HF to form KHF_2. The compound contains the species.
(A) K^+ , F^-, and H^+ (B) K^+, F^-, and HF
(C) K^+ and $\left[HF_2\right]^-$ (D) $\left[KHF\right]^+$ and F^-

Paragraph–2

K_c and K_p are the two ways of expressing equilibrium constants at a given temperature. The value of K_p and K_c are constant and do not depend on the amount or concentration of the active masses but changes with the temperature according to van Hoff's equation. Also the relationship between K_p and K_c is dependent on the difference in gaseous reactants and products. K_p is useful in determining the thermodynamic relationship of ΔG with reaction quotient and equilibrium constant.

35. For the reaction $N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$, K_p at 600^oC (T_1) is 1.78×10^4 and K_p at 1000^oC (T_2) is 2.28×10^4. it follows that
(A) ΔH is negative (B) K_c value is smaller than that of K_p
(C) units of K_p is L atm^{-1} (D) unit of K_c is mol^{-1} L^1

36. The K_p value for a gas phase homogeneous reaction is 0.9 atm at 300K, then K_c value of the reaction is
(A) 0.9 mol L^{-1} (B) 0.0365 mol L^{-1} (C) 0.009 mol L^{-1} (D) data insufficient

Space for rough work

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 28)

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37. The index of the nilpotent matrix $\begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$ is

(A) 4 (B) 3 (C) 5 (D) 2

38. If $f(x) = \begin{vmatrix} \cos(x+\alpha) & \cos(x+\beta) & \cos(x+\gamma) \\ \sin(x+\alpha) & \sin(x+\beta) & \sin(x+\gamma) \\ \sin(\beta-\gamma) & \sin(\gamma-\alpha) & \sin(\alpha-\beta) \end{vmatrix}$ then $f(\theta) - 2f(\phi) + f(\varphi)$ is equal to

(A) 0 (B) 1 (C) 2 (D) 4

39. In a quadrilateral ABCD, which of the following is always true

(A) $\overline{AB} + \overline{AC} = \overline{DC} + \overline{DB}$ (B) $\overline{BA} + \overline{AC} = \overline{DC} + \overline{BD}$

(C) $\overline{BA} + \overline{DC} = \overline{CA} + \overline{DB}$ (D) $\overline{AB} + \overline{DC} = \overline{AC} + \overline{DB}$

40. Let $A + 2B = \begin{bmatrix} 1 & 2 & 0 \\ 6 & -3 & 3 \\ -5 & 3 & 1 \end{bmatrix}$ and $2A - B = \begin{bmatrix} 2 & -1 & 5 \\ 2 & -1 & 6 \\ 0 & 1 & 2 \end{bmatrix}$, then $tr(A) - tr(B)$ has the value equal to

(A) 0 (B) 1 (C) 2 (D) none of these

41. $\Delta_1 = \begin{vmatrix} y^5z^6(z^3-y^3) & x^4z^6(x^3-z^3) & x^4y^5(y^3-x^3) \\ y^2z^3(y^6-z^6) & xz^3(z^6-x^6) & xy^2(x^6-y^6) \\ y^2z^3(z^3-y^3) & xz^3(x^3-z^3) & xy^2(y^3-x^3) \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} x & y^2 & z^3 \\ x^4 & y^5 & z^6 \\ x^7 & y^8 & z^9 \end{vmatrix}$, then $\Delta_1\Delta_2$ is equal to

(A) ${\Delta_2}^3$ (B) ${\Delta_2}^2$ (C) ${\Delta_2}^4$ (D) none of these

Space for rough work

42. If $D_k = \begin{vmatrix} 1 & n & n \\ 2k & n^2+n+1 & n^2+n \\ 2k-1 & n^2 & n^2+n+1 \end{vmatrix}$ and $\sum_{k=1}^{n} D_k = 56$, then n equals

(A) 4 (B) 6 (C) 8 (D) none of these

43. Given $2x - y + 2z = 2$, $x - 2y + z = -4$, $x + y + \lambda z = 4$, then the value of λ such that the given system of equation has no solution is

(A) –3 (B) 1 (C) 0 (D) 3

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44. If the matrix $A = \begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$ is an orthogonal matrix, then

(A) $a = \pm\frac{1}{\sqrt{2}}$ (B) $b = \pm\frac{1}{\sqrt{5}}$ (C) $c = \pm\frac{1}{\sqrt{3}}$ (D) all the above

45. If matrix $A = \begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$, there a, b, c are real positive numbers such that $abc = 1$ and $A^TA = 1$, then which of the following options is/are correct

(A) $a + b + c = 2$ (B) $a + b + c = 1$ (C) $a^3 + b^3 + c^3 = 5$ (D) $a^3 + b^3 + c^3 = 4$

Space for rough work

46. If $\Delta = \begin{vmatrix} 1+a^2-b^2 & 2ab & -2b \\ 2ab & 1-a^2+b^2 & 2a \\ 2b & -2a & 1-a^2-b^2 \end{vmatrix}$, then choose the correct options(s)

(A) $\Delta = (a^2 + b^2 + 1)^2$ (B) $\Delta = (1 + a^2 + b^2)^3$ (C) $\Delta \geq 27a^2b^2$ (D) $\Delta \geq 9a^2b^2$

47. Solve the following system of equations:
$(b + c)(y + z) – ax = b – c$
$(c + a)(x + z) – by = c – a$
$(a + b)(x + y) – cz = a – b$, where $a + b + c \neq 0$

(A) $x = \frac{c-b}{a+b+c}$ (B) $y = \frac{c-a}{a+b+c}$ (C) $z = \frac{a-b}{a+b+c}$ (D) $z = \frac{b-a}{a+b+c}$

48. If $x \neq a$, $y \neq b$, $z \neq c$, and $\begin{vmatrix} x & b & c \\ a & y & c \\ a & b & z \end{vmatrix} = 0$, then which of the following is/are correct

(A) $\frac{c}{z-c} + \frac{x}{x-a} + \frac{y}{y-b} = 0$ (B) $\frac{c}{z-c} + \frac{x}{x-a} + \frac{b}{y-b} = 0$

(C) $\frac{x}{x-a} + \frac{y}{y-b} + \frac{z}{z-c} = 2$ (D) $\frac{x}{x-a} + \frac{y}{y-b} + \frac{z}{z-c} = 1$

49. For the following system of equations which of the following options is/are true:
$2x + py + 6z = 8$; $x + 2y + qz = 5$; $x + y + 3z = 4$
(A) the given system of equations will have no solution when $q = 3$, $p = 2$, $\Delta = 0$, $\Delta_1 \neq 0$
(B) the given system of equations will have unique solution when $\Delta \neq 0$, $p \neq 2$, $q \neq 3$
(C) the given system of equations will have infinitely many solutions when $q = 3$, $\Delta = 0$, $\Delta_1 = 0$, $\Delta_2 = 0$, $\Delta_3 = 0$
(D) the given system of equation will have infinitely many solutions when $p = 2$, $\Delta = 0$, $\Delta_1 = 0$, $\Delta_2 = 0$, $\Delta_3 = 0$

50. If the resultant of three vectors $\bar{F}_1 = p\hat{i} + 3\hat{j} - \hat{k}$, $\bar{F}_2 = 6\hat{i} - \hat{k}$ and $\bar{F}_3 = -5\hat{i} + \hat{j} + 2\hat{k}$ acting on a particle has magnitude equal to 5 units, then the value of p is
(A) –6 (B) –4 (C) 2 (D) 4

Space for rough work

SECTION 3 (Maximum Marks: 18)

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.

Paragraph–1

Consider the polynomial function f(x) = $\begin{vmatrix} (1+x)^a & (1+2x)^b & 1 \\ 1 & (1+x)^a & (1+2x)^b \\ (1+2x)^b & 1 & (1+x)^a \end{vmatrix}$, a, b being positive integers

51. The constant term in f(x) is
(A) 2 (B) 1 (C) –1 (D) 0

52. The coefficient of x in f(x) is
(A) 2^a (B) $2^a - 3 \times 2^b + 1$ (C) 0 (D) none of these

Paragraph–2

Let A = $\begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ satisfies $A^n = A^{n-2} + A^2 - I$ for $n \geq 3$. And trace of a square matrix X is equal to the sum of elements in its principal diagonal. Further consider a matrix $\underset{3\times3}{U}$ with its column as U_1, U_2, U_3 such that

$A^{50}U_1 = \begin{bmatrix} 1 \\ 25 \\ 25 \end{bmatrix}$, $A^{50}U_2 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$, $A^{50}U_3 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$, then answer the following questions

53. The values of $|A^{50}|$ equals
(A) 0 (B) 1 (C) –1 (D) 25

54. Trace of A^{50} equals
(A) 0 (B) 1 (C) 2 (D) 3

Space for rough work

FIITJEE RET – 10

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2017 (P2)_SET–A

DATE: 10.09.2018

ANSWERS

PHYSICS

1.	**B**	2.	**C**	3.	**D**	4.	**A**
5.	**C**	6.	**C**	7.	**B**	8.	**A,B**
9.	**A,C,D**	10.	**A,C**	11.	**A,B,D**	12.	**C, D**
13.	**B,C**	14.	**A,B,C,D**	15.	**A**	16.	**A**
17.	**C**	18.	**B**				

CHEMISTRY

19.	**C**	20.	**C**	21.	**A**	22.	**C**
23.	**B**	24.	**B**	25.	**B**	26.	**A, B, C**
27.	**A, B, D**	28.	**A, B, C, D**	29.	**C, D**	30.	**C**
31.	**C, D**	32.	**A, C**	33.	**D**	34.	**C**
35.	**B**	36.	**B**				

MATHEMATICS

37.	**B**	38.	**A**	39.	**B or D**	40.	**C**
41.	**A**	42.	**D**	43.	**B**	44.	**AC**
45.	**Bonus**	46.	**BC**	47.	**AD**	48.	**BC**
49.	**BD**	50.	**BC**	51.	**D**	52.	**C**
53.	**B**	54.	**D**				

FIITJEE RET – 10

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2017 (P2)_SET–B

DATE: 03.09.2018

Time: 3 hours **Maximum Marks: 183**

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 54 questions.
6. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
7. Fill in the boxes provided for Name and Enrolment No.
8. The answer sheet, a machine-readable Objective Response (ORS), is provided separately.
9. DO NOT TAMPER WITH / MULTILATE THE ORS OR THE BOOKLET.

B. Filling in the OMR:

6. The instructions for the OMR sheet are given on the OMR itself.

C. Question paper format & Marking Scheme

7. Each part has three sections as detailed in the following table:

Section	Question Type	Number of Questions	Category wise Marks Each Question				Maximum marks of the section
			Full Marks	Partial Marks	Zero Marks	Negative Marks	
1	**Single Correct Option**	7	**+3** If only the bubble corresponding to the correct option is darkened	——	**0** If none of the bubbles is darkened	**–1** In all other cases	**21**
2	**One or more correct option(s)**	7	**+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.	**+1** For darkening a bubble corresponding to each correct option, provided **NO** incorrect option is darkened.	**0** If none of the bubbles is darkened.	**–2** In all other case.	**28**
3	**Comprehension**	4	**+3** If only the bubble corresponding to the correct option is darkened	——	**0** In all other case.	——	**12**

Don't write / mark your answers in this question booklet.
If you mark the answers in question booklet, you will not be allowed to continue the exam.

NAME: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

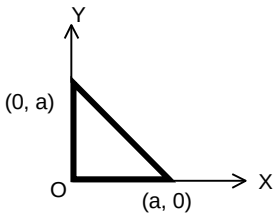
ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐☐☐

PAPER–II
PART I: PHYSICS
SECTION 1 (Maximum Marks: 28)

* This section contains **SEVEN** questions.
* Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
* For each question, darken the bubble corresponding to all the correct option in the ORS.

1. Two particles of equal masses have velocities $\vec{v}_1 = 2\hat{i}\ m/s$ and $\vec{v}_2 = 2\hat{j}\ m/s$. The first particle has an acceleration $\vec{a}_1 = \left(3\hat{i} + 3\hat{j}\right) m/s^2$, while the acceleration of the other particle is zero. The centre of mass of the two particles moves in a
(A) circle (B) parabola (C) straight line (D) ellipse

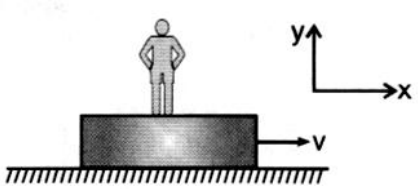
2. Three rods of the same mass are placed as shown in the figure. What will be the co-ordinate of centre of mass of the system?
(A) (a/2, a/2) (B) (a/√2, a/√2)
(C) (a/3, a/3) (D) none of these



3. A particle of mass 4m which is at rest explodes into three fragments. Two of the fragments each of mass m are found to move with a speed 'v' each in mutually perpendicular directions. Find the minimum energy released in the process of explosion.
(A) $(2/3)mv^2$ (B) $(3/2)mv^2$ (C) $(4/3)mv^2$ (D) $(3/4)mv^2$

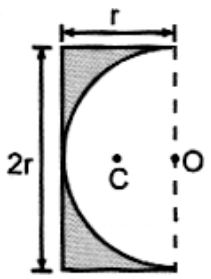
4. A shell of mass 2 m projected with a speed 'u' at an angle θ to the horizontal explodes at the highest point of its motion into two pieces of mass 'm' each. If one piece whose initial speed is zero, falls vertically, find the distance at which the other piece will fall from the point of projection.
(A) $\frac{3u^2 \sin 2\theta}{g}$ (B) $\frac{3}{2}\frac{u^2 \sin 2\theta}{g}$
(C) $\frac{u^2 \sin 2\theta}{g}$ (D) None of these

5. A man and a plank of same mass are moving with a velocity v along positive x –axis. At some time man jumps along negative x – axis with a velocity v with respect to ground, then the speed of the plank is.
(A) v (B) 2 v
(C) 3 v (D) None of these



Space for rough work

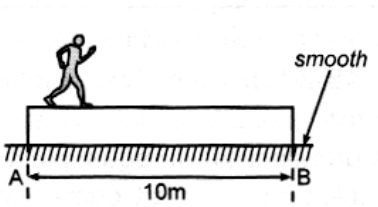
6. A semicircular portion of radius 'r' is cut from a uniform rectangular plate as shown in figure. The distance of centre of mass 'C' of remaining plate, from point 'O' is



(A) $\frac{2r}{(3-\pi)}$ (B) $\frac{3r}{2(4-\pi)}$

(C) $\frac{2r}{(4+\pi)}$ (D) $\frac{2r}{3(4-\pi)}$

7. In the figure shown mass of person is 40 kg and mass of plank is 20 kg. If person reaches the other end in 2 seconds with constant velocity, then find the velocity of person (w.r.t ground). Initially the system was at rest.



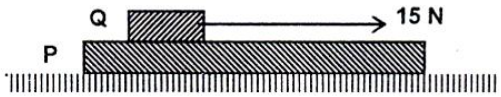
(A) $5/3\ ms^{-1}$ (B) $5\ ms^{-1}$

(C) $10/3\ ms^{-1}$ (D) None of these

SECTION 2 (Maximum Marks: 15)

- This section contains **SEVEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get –2 marks, as a wrong option is also darkened.

8. A long plank P of mass 5 kg is placed on a smooth floor. On P is placed a block Q of mass 2 kg. The coefficient of friction between P and Q is 0.5. A horizontal force of 15N is applied to Q, as shown in figure and you may take g as 10 N/kg. Now,



(A) the reaction force on Q due to P is 10 N
(B) the acceleration of Q relative to P is 2.5 m/s^2
(C) the acceleration of P relative to the floor is 2.0 m/s^2
(D) the acceleration of centre-of-mass of P + Q system relative to the floor is 15/7 m/s^2

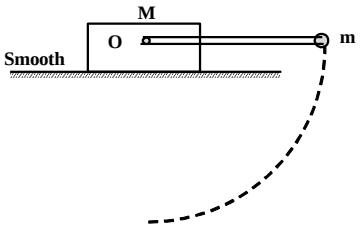
Space for rough work

9. If the external forces acting on a system have zero resultant then the centre of mass
(A) must not move (B) may move
(C) must not accelerate (D) may accelerate

10. A non-zero external forces acts on a system of particles. At any instant t, the velocity and the acceleration of Centre of mass are found to be u_0 and a_0 . Then it is possible that
(A) $u_0 = 0; a_0 = 0$ (B) $u_0 \neq 0; a_0 \neq 0$ (C) $u_0 \neq 0; a_0 = 0$ (D) $u_0 = 0; a_0 \neq 0$

11. Two particles of masses m and 2m move with accelerations $2a\hat{i}$ and $-a\hat{i}$ respectively.
(A) the acceleration CM is zero
(B) the net force acting on (m + 2m) is zero
(C) the velocity of CM must be zero
(D) the bodies must interact with each other

12. A block of mass M is placed on a smooth horizontal floor. The block has a massless rod of length ℓ pivoted on it at point O. The rod has a point mass m attached to its end. The whole system is released from the position shown. Then



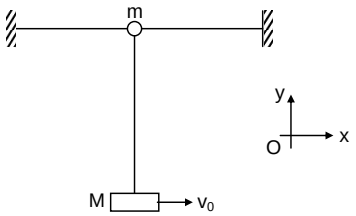
(A) The velocity of M when the rod becomes vertical is $m\sqrt{\frac{2g\ell}{M(M+m)}}$

(B) The velocity of M when the rod becomes vertical is $M\sqrt{\frac{2g\ell}{m(M+m)}}$

(C) Horizontal acceleration of centre of mass of the system is always zero.
(D) At any time linear momentum of the system will be conserved in horizontal direction

Space for rough work

13. A block of mass M suspended from a smooth ring of mass m by an inextensible light string of length ℓ is pushed towards the right with a speed v. If the ring can slide along the horizontal rod, then, for the system (M + m)



(A) at any instance $(a_C)_x = 0$

(B) initially $(a_C)_y = \frac{v^2}{\ell} \uparrow$

(C) initially N = (M + m)g + $\frac{Mv^2}{\ell}$, where N = normal reaction between the ring and horizontal rod

(D) initially $T = \frac{Mmv^2}{(M+m)\ell}$, where T = tension in the string

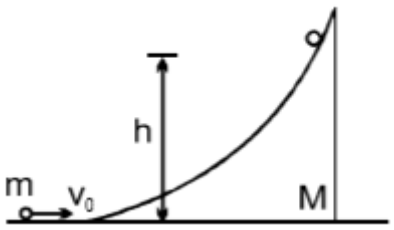
14. When a bullet is fired from a gun
(A) kinetic energy of bullet is more than that of gun
(B) acceleration of bullet is more than that of gun during firing
(C) momentum of bullet is more than that of gun
(D) velocity of bullet is more than that of gun

SECTION 3 (Maximum Marks: 18)

∗ This section contains **TWO** paragraphs.
∗ Based on each paragraph, there are **TWO** questions.
∗ Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
∗ For each question, darken the bubble corresponding to the correct option in the ORS.

Paragraph–1

A particle of mass m moving horizontal with v_0 strikes a smooth wedge of mass M, as shown in figure. After collision, the ball starts moving up the inclined face of the wedge and rises to a maximum height h on it. After that it starts sliding down the inclined. Now Answer the questions
Take all the surfaces smooth



15. The maximum height h attained by the particle is

(A) $\left(\frac{m}{m+M}\right)\frac{v_0^2}{2g}$ (B) $\left(\frac{m}{M}\right)\frac{v_0^2}{2g}$ (C) $\left(\frac{M}{m+M}\right)\frac{v_0^2}{2g}$ (D) None of these

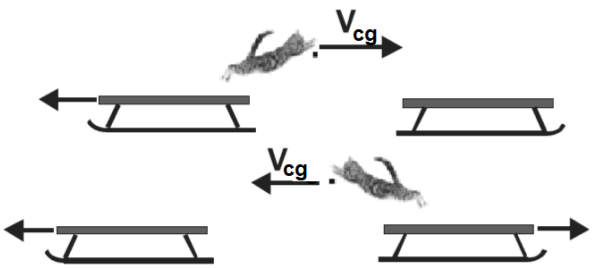
Space for rough work

16. Suppose m = M then what will be the maximum velocity attained by the inclined wedge during the entire motion ?

(A) $\frac{v_0}{2}$ (B) v_0 (C) $\frac{v_0}{4}$ (D) None of these

Paragraph–2

A strange cat with a mass m_c is sitting at rest on the left sled of a pair of identical sleds. The sleds have mass m_s and sit on frictionless ice. Suddenly, the cat leaps to the right sled, traveling with a horizontal speed V_{cg} measured with respect to the ground. The instant the cat reaches the right sled, it turns around and leaps back to the left sled. The horizontal component of the cat's speed is again V_{cg} measured with respect to the ground.



17. What is the final speed of the right sled ?

(A) $\frac{2m_cV_{cg}}{m_s}$ (B) $\frac{m_cV_{cg}}{m_s}$ (C) $\frac{2(m_c+m_s)V_{cg}}{m_s}$ (D) zero

18. What is the final speed of Left sled in terms of the masses of the cat and sleds and the cat's leaping speed ? (The cat remains on the left sled after its return)

(A) $\frac{2m_cv_{cg}}{m_s+m_c}$ (B) $\frac{2m_sv_{cg}}{m_s+m_c}$ (C) $\frac{2m_cv_{cg}}{m_s}$ (D) $\frac{m_cv_{cg}}{m_s}$

Space for rough work

PART II: CHEMISTRY

SECTION 1 (Maximum Marks: 28)

* This section contains **SEVEN** questions.
* Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
* For each question, darken the bubble corresponding to all the correct option in the ORS.

19. Which of the following is not considered as vander waals' force ?
(A) dipole–dipole interaction (B) ion–dipole interaction
(C) dipole–induced dipole interaction (D) London forces

20. 2 moles of PCl_5 is present in vessel 2 lit capacity, at equilibrium 40% of PCl_5 is dissociates, calculate Kc
(A) 0.366 (B) 0.266 (C) 26.6 (D) 0.466

21. Eight mole of a gas AB_3 attain equilibrium in a closed vessel of volume $2dm^3$ as,
$2AB_3 \rightleftharpoons A_2(s) + 3B_2(g)$. If at equilibrium 2 mole of A_2 are present, then equilibrium constant is
(A) 27 $mol^2 . L^{-2}$ (B) 6.75 $mol^2\ L^{-2}$ (C) 3 $mol^2\ L^{-2}$ (D) 36 $mol^2\ L^{-2}$

22. For the equilibrium $AB\ g \rightleftharpoons A\ g + B\ g$, at a given temperature $\frac{1}{3}rd$ of AB is dissociated, then $\frac{P}{K_p}$ will be numerically equal to.....
(A) 4 (B) 6 (C) 8 (D) 2

23. For the equilibrium, $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, $K_c = \frac{\alpha^2}{(1-\alpha)V}$, temperature remaining constant
(A) K_c will increase with the increase in volume
(B) K_c will increase with the decrease in volume
(C) K_c will not change with the change in volume
(D) K_c may increase or decrease with the change in volume depending upon its numerical value

Space for rough work

24. For the reaction, A $\rightleftharpoons$ B. $E_{a(f)}$ and $E_{a(b)}$ value are 30.5 and 40.5 Kcal/mol respectively. Calculate ΔH for the forward reaction.
(A) –10 Kcal/mole (B) 71 kcal/mole
(C) –71 Kcal/ mole (D) +10 kcal/mole

25. For a reversible reaction $2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$ total pressure of the system at equilibrium 2.4 atm. Partial pressure N_2 and H_2 at equilibrium are 0.8 atm and 0.4 atm respectively calculate Kp.
(A) 0.355 (B) 0.00395 (C) 0.0355 (D) 0.0395

SECTION 2 (Maximum Marks: 15)

- This section contains **SEVEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get –2 marks, as a wrong option is also darkened.

26. In the reaction, $A_2(g) + 4B_2(g) \rightleftharpoons 2AB_4(g), \Delta H > 0$. The decomposition of $AB_4(g)$ will be favoured at
(A) low temperature & high pressure
(B) high temperature & low pressure
(C) low temperature & Low pressure
(D) high temperature & high pressure

27. For the reaction, $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$, the forward reaction at constant temperature is favoured by
(A) introducing an inert gas at constant volume
(B) introducing chlorine gas at constant volume
(C) introducing an inert gas at constant pressure
(D) increasing the volume of the container .

28. Which of the following statement(s) is/are correct about chemical equilibrium
(A) It is dynamic in nature
(B) by using catalyst position of equilibrium changes
(C) at equilibrium rate of forward reaction is equal to rate of backward reaction.
(D) at equilibrium always concentration of reactants is equal to concentration of products.

Space for rough work

29. $N_2 + O_2 \rightleftharpoons 2NO, K_1; \left(\frac{1}{2}\right)N_2 + \left(\frac{1}{2}\right)O_2 \rightleftharpoons NO, K_2;$

$2NO \rightleftharpoons N_2 + O_2, K_3; NO \rightleftharpoons \left(\frac{1}{2}\right)N_2 + \left(\frac{1}{2}\right)O_2, K_4$

Correct relation(s) between K_1, K_2, K_3 and K_4 is/are :

(A) $K_1 \times K_3 = 1$ (B) $\sqrt{K_1} \times K_4 = 1$

(C) $\sqrt{K_3} \times K_2 = 1$ (D) None of these

30. Equilibrium constant is independent of

(A) initial concentration of reactants and products (B) pressure

(C) temperature (D) catalyst

31. Favourable conditions for the forward reaction.

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ ΔH = –ve

(A) Addition of N_2 & H_2 time to time (B) removal of NH_3 time to time

(C) High pressure (D) low temperature

32. In which of the following equilibrium, the value of Kp is less than Kc ?

(A) $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ (B) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

(C) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ (D) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

SECTION 3 (Maximum Marks: 18)

∗ This section contains **TWO** paragraphs.
∗ Based on each paragraph, there are **TWO** questions.
∗ Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
∗ For each question, darken the bubble corresponding to the correct option in the ORS.

Paragraph–1

K_c and K_p are the two ways of expressing equilibrium constants at a given temperature. The value of K_p and K_c are constant and do not depend on the amount or concentration of the active masses but changes with the temperature according to van Hoff's equation. Also the relationship between K_p and K_c is dependent on the difference in gaseous reactants and products. K_p is useful in determining the thermodynamic relationship of ΔG with reaction quotient and equilibrium constant.

33. For the reaction $N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$, K_p at 600^oC (T_1) is 1.78×10^4 and K_p at 1000^oC (T_2) is 2.28×10^4. it follows that

(A) ΔH is negative (B) K_c value is smaller than that of K_p

(C) units of K_p is L atm^{-1} (D) unit of K_c is mol^{-1} L^1

Space for rough work

34. The K_p value for a gas phase homogeneous reaction is 0.9 atm at 300K, then K_c value of the reaction is
(A) 0.9 mol L^{-1} (B) 0.0365 mol L^{-1} (C) 0.009 mol L^{-1} (D) data insufficient

Paragraph–2

The concept of H–bonding was introduced to explain the abnormality in some molecules. H–atom covalently linked with N, O or F in a molecule is held up on other side with dipole–dipole attraction with same or other molecule of same or other compound show H–bonding. H–bonding between two molecules in called intermolecular H–bonding. H–bonding within a molecule is called intramolecular H–bonding or chelation. Intermolecular H–bonding give rise to cluster formation.

35. Which of the following statement is wrong
(A) para nitrophenol is less volatile than ortho nitro phenol
(B) The H–bond strength decreasing order is
H–F - - - - H > H–O - - - H > H – N - - -H
(C) All the three atoms (e.g., F–H - - -F–H) involved lie in one plane
(D) H–bonding is stronger than covalent bond.

36. KF combines with HF to form KHF_2. The compound contains the species.
(A) K^+ , F^-, and H^+ (B) K^+, F^-, and HF
(C) K^+ and $\left[HF_2\right]^-$ (D) $\left[KHF\right]^+$ and F^-

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 28)

* This section contains **SEVEN** questions.
* Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
* For each question, darken the bubble corresponding to all the correct option in the ORS.

37. $\Delta_1 = \begin{vmatrix} y^5z^6\left(z^3-y^3\right) & x^4z^6\left(x^3-z^3\right) & x^4y^5\left(y^3-x^3\right) \\ y^2z^3\left(y^6-z^6\right) & xz^3\left(z^6-x^6\right) & xy^2\left(x^6-y^6\right) \\ y^2z^3\left(z^3-y^3\right) & xz^3\left(x^3-z^3\right) & xy^2\left(y^3-x^3\right) \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} x & y^2 & z^3 \\ x^4 & y^5 & z^6 \\ x^7 & y^8 & z^9 \end{vmatrix}$, then $\Delta_1\Delta_2$ is equal to

(A) ${\Delta_2}^3$ (B) ${\Delta_2}^2$ (C) ${\Delta_2}^4$ (D) none of these

Space for rough work

38. If $D_k = \begin{vmatrix} 1 & n & n \\ 2k & n^2+n+1 & n^2+n \\ 2k-1 & n^2 & n^2+n+1 \end{vmatrix}$ and $\sum_{k=1}^{n} D_k = 56$, then n equals

(A) 4 (B) 6 (C) 8 (D) none of these

39. Given $2x - y + 2z = 2$, $x - 2y + z = -4$, $x + y + \lambda z = 4$, then the value of λ such that the given system of equation has no solution is

(A) –3 (B) 1 (C) 0 (D) 3

40. The index of the nilpotent matrix $\begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$ is

(A) 4 (B) 3 (C) 5 (D) 2

41. If $f(x) = \begin{vmatrix} \cos(x+\alpha) & \cos(x+\beta) & \cos(x+\gamma) \\ \sin(x+\alpha) & \sin(x+\beta) & \sin(x+\gamma) \\ \sin(\beta-\gamma) & \sin(\gamma-\alpha) & \sin(\alpha-\beta) \end{vmatrix}$ then $f(\theta) - 2f(\phi) + f(\varphi)$ is equal to

(A) 0 (B) 1 (C) 2 (D) 4

42. In a quadrilateral ABCD, which of the following is always true

(A) $\overline{AB} + \overline{AC} = \overline{DC} + \overline{DB}$ (B) $\overline{BA} + \overline{AC} = \overline{DC} + \overline{BD}$

(C) $\overline{BA} + \overline{DC} = \overline{CA} + \overline{DB}$ (D) $\overline{AB} + \overline{DC} = \overline{AC} + \overline{DB}$

43. Let $A + 2B = \begin{bmatrix} 1 & 2 & 0 \\ 6 & -3 & 3 \\ -5 & 3 & 1 \end{bmatrix}$ and $2A - B = \begin{bmatrix} 2 & -1 & 5 \\ 2 & -1 & 6 \\ 0 & 1 & 2 \end{bmatrix}$, then tr(A) – tr(B) has the value equal to

(A) 0 (B) 1 (C) 2 (D) none of these

Space for rough work

SECTION 2 (Maximum Marks: 15)

- This section contains **SEVEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get –2 marks, as a wrong option is also darkened.

44. If $x \neq a$, $y \neq b$, $z \neq c$, and $\begin{vmatrix} x & b & c \\ a & y & c \\ a & b & z \end{vmatrix} = 0$, then which of the following is/are correct

(A) $\frac{c}{z-c}+\frac{x}{x-a}+\frac{y}{y-b}=0$ (B) $\frac{c}{z-c}+\frac{x}{x-a}+\frac{b}{y-b}=0$

(C) $\frac{x}{x-a}+\frac{y}{y-b}+\frac{z}{z-c}=2$ (D) $\frac{x}{x-a}+\frac{y}{y-b}+\frac{z}{z-c}=1$

45. For the following system of equations which of the following options is/are true:
$2x + py + 6z = 8$; $x + 2y + qz = 5$; $x + y + 3z = 4$
(A) the given system of equations will have no solution when $q = 3$, $p = 2$, $\Delta = 0$, $\Delta_1 \neq 0$
(B) the given system of equations will have unique solution when $\Delta \neq 0$, $p \neq 2$, $q \neq 3$
(C) the given system of equations will have infinitely many solutions when $q = 3$, $\Delta = 0$, $\Delta_1 = 0$, $\Delta_2 = 0$, $\Delta_3 = 0$
(D) the given system of equation will have infinitely many solutions when $p = 2$, $\Delta = 0$, $\Delta_1 = 0$, $\Delta_2 = 0$, $\Delta_3 = 0$

46. If the resultant of three vectors $\bar{F}_1 = p\hat{i} + 3\hat{j} - \hat{k}$, $\bar{F}_2 = 6\hat{i} - \hat{k}$ and $\bar{F}_3 = -5\hat{i} + \hat{j} + 2\hat{k}$ acting on a particle has magnitude equal to 5 units, then the value of p is
(A) –6 (B) –4 (C) 2 (D) 4

Space for rough work

47. If the matrix $A = \begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$ is an orthogonal matrix, then

(A) $a = \pm\frac{1}{\sqrt{2}}$ (B) $b = \pm\frac{1}{\sqrt{5}}$ (C) $c = \pm\frac{1}{\sqrt{3}}$ (D) all the above

48. If matrix $A = \begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$, there a, b, c are real positive numbers such that abc = 1 and $A^TA = 1$, then which of the following options is/are correct

(A) a + b + c = 2 (B) a + b + c = 1 (C) $a^3 + b^3 + c^3 = 5$ (D) $a^3 + b^3 + c^3 = 4$

49. If $\Delta = \begin{vmatrix} 1+a^2-b^2 & 2ab & -2b \\ 2ab & 1-a^2+b^2 & 2a \\ 2b & -2a & 1-a^2-b^2 \end{vmatrix}$, then choose the correct options(s)

(A) $\Delta = (a^2 + b^2 + 1)^2$ (B) $\Delta = (1 + a^2 + b^2)^3$ (C) $\Delta \geq 27a^2b^2$ (D) $\Delta \geq 9a^2b^2$

50. Solve the following system of equations:

(b + c)(y + z) – ax = b – c

(c + a)(x + z) – by = c – a

(a + b)(x + y) – cz = a – b, where $a + b + c \neq 0$

(A) $x = \frac{c-b}{a+b+c}$ (B) $y = \frac{c-a}{a+b+c}$ (C) $z = \frac{a-b}{a+b+c}$ (D) $z = \frac{b-a}{a+b+c}$

Space for rough work

SECTION 3 (Maximum Marks: 18)

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.

Paragraph–1

Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ satisfies $A^n = A^{n-2} + A^2 - I$ for $n \geq 3$. And trace of a square matrix X is equal to the sum of elements in its principal diagonal. Further consider a matrix $\underset{3\times3}{U}$ with its column as U_1, U_2, U_3 such that $A^{50}U_1 = \begin{bmatrix} 1 \\ 25 \\ 25 \end{bmatrix}$, $A^{50}U_2 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$, $A^{50}U_3 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$, then answer the following questions

51. The values of $|A^{50}|$ equals
(A) 0 (B) 1 (C) –1 (D) 25

52. Trace of A^{50} equals
(A) 0 (B) 1 (C) 2 (D) 3

Paragraph–2

Consider the polynomial function $f(x) = \begin{vmatrix} (1+x)^a & (1+2x)^b & 1 \\ 1 & (1+x)^a & (1+2x)^b \\ (1+2x)^b & 1 & (1+x)^a \end{vmatrix}$, a, b being positive integers

53. The constant term in f(x) is
(A) 2 (B) 1 (C) –1 (D) 0

54. The coefficient of x in f(x) is
(A) 2^a (B) $2^a - 3 \times 2^b + 1$ (C) 0 (D) none of these

Space for rough work

FIITJEE RET – 10

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2017 (P2)_SET–B

DATE: 10.09.2018

ANSWERS

PHYSICS

1.	**C**	2.	**C**	3.	**B**	4.	**B**
5.	**C**	6.	**D**	7.	**A**	8.	**C, D**
9.	**B,C**	10.	A,**B,C,D**	11.	**A,B**	12.	**A,C,D**
13.	**A,C**	14.	**A,B,D**	15.	**C**	16.	**B**
17.	**A**	18.	**A**				

CHEMISTRY

19.	**B**	20.	**B**	21.	**B**	22.	**C**
23.	**C**	24.	**A**	25.	**C**	26.	**C**
27.	**C, D**	28.	**A, C**	29.	**A, B, C**	30.	**A, B, D**
31.	**A, B, C, D**	32.	**C, D**	33.	**B**	34.	**B**
35.	**D**	36.	**C**				

MATHEMATICS

37.	**A**	38.	**D**	39.	**B**	40.	**B**
41.	**A**	42.	**B or D**	43.	**C**	44.	**BC**
45.	**BD**	46.	**BC**	47.	**AC**	48.	**Bonus**
49.	**BC**	50.	**AD**	51.	**B**	52.	**D**
53.	**D**	54.	**C**				